

WHAT IS CLAIMED IS:

1. An epoxy or phenolic functional polyester/polyether oligomer or polymer having an epoxy or phenolic functionality of greater than 2 and comprising 5 moieties derived from diglycidyl ethers or diglycidyl esters, anhydrides and dihydric phenols.

2. The epoxy or phenolic functional polyester/polyether oligomer or polymer of Claim 1 wherein the diglycidyl ether is selected from the diglycidyl ethers of bisphenol A; 4,4'-sulfonyldiphenol; 10 4,4-oxydiphenol; 4,4'-dihydroxybenzophenone; resorcinol; hydroquinone; 9,9'-bis(4-hydroxyphenyl)fluorene; 4,4'-dihydroxybiphenyl and 4,4'-dihydroxy-alpha-methylstilbene.

15 3. The epoxy-functional polyester/polyether oligomer or polymer of Claim 1 wherein the diglycidyl ester is selected from the diglycidyl esters of dicarboxylic acids.

4. The epoxy or phenolic functional 20 polyester/polyether oligomer or polymer of Claim 1 wherein the anhydride is selected from diglycolic anhydride, dichloromaleic anhydride, maleic anhydride, succinic anhydride, glutaric anhydride, citraconic anhydride, itaconic anhydride, tetrabromophthalic anhydride, phthalic 25 anhydride, tetrahydrophthalic anhydride, hexahydrophthalic anhydride, tetrachlorophthalic anhydride, 4-methylhexahydrophthalic anhydride, methyl-5-norbornene-2,3-dicarboxylic anhydride, 1,8-naphthalic anhydride, trimellitic anhydride and 1,2,4,5-benzenetetracarboxylic 30 dianhydride.

5. The epoxy or phenolic functional polyester/polyether oligomer or polymer of Claim 1 wherein the anhydride is selected from phthalic anhydride, maleic anhydride, tetrahydrophthalic anhydride,

5 4-methylhexahydrophthalic anhydride, hexahydrophthalic anhydride, methyl-5-norbornene-2,3-dicarboxylic anhydride and succinic anhydride.

6. The epoxy or phenolic functional polyester/polyether oligomer or polymer of Claim 1 wherein  
10 the anhydride is selected from phthalic anhydride, 4-methylhexahydro-phthalic anhydride, tetrahydrophthalic anhydride, hexahydrophthalic anhydride and succinic anhydride.

7. The epoxy or phenolic functional  
15 polyester/polyether oligomer or polymer of Claim 1 wherein the dihydric phenol is selected from 4,4'-isopropylidene bisphenol (bisphenol A), 4,4'-dihydroxydiphenyl-ethylmethane, 3,3'-dihydroxy-diphenyl-diethylmethane, 3,4'-dihydroxy-diphenylmethylpropylmethane,  
20 4,4'-dihydroxydiphenyloxide, 4,4'-dihydroxydiphenyl-cyanomethane, 4,4'-dihydroxy-biphenyl, 4,4'-dihydroxybenzophenone, 4,4'-dihydroxydiphenyl sulfide, 4,4'-dihydroxydiphenyl sulfone, 2,6-dihydroxynaphthalene, 1,4'-dihydroxynaphthalene,  
25 catechol, resorcinol and hydroquinone.

8. The epoxy or phenolic functional polyester/polyether oligomer or polymer of Claim 1 wherein the dihydric phenol is selected from bisphenol A, hydroquinone and mixtures thereof.

30 9. The epoxy or phenolic functional polyester/polyether oligomer or polymer of Claim 1 wherein

the catalyst is selected from amines, phosphines, quaternary ammonium and phosphonium salts.

10. The epoxy or phenolic functional polyester/polyether oligomer or polymer of Claim 1 wherein the catalyst is selected from, tetraethylammonium chloride, tetraethylammonium bromide, tetraethylammonium iodide, tetraethylammonium hydroxide, tetra(n-butyl)ammonium chloride, tetra(n-butyl)ammonium bromide, tetra(n-butyl)ammonium iodide, tetra(n-butyl)ammonium hydroxide, tetra(n-octyl)ammonium chloride, tetra(n-octyl)ammonium bromide, tetra(n-octyl)ammonium iodide, tetra(n-octyl)ammonium hydroxide, methyltris(n-octyl)ammonium chloride, ethyltriphenylphosphonium acetate, ethyltritolylphosphonium acetate, 15 tetraphenylphosphonium bromide, tetraphenylphosphonium chloride, and tetraphenylphosphonium iodide.

11. The epoxy or phenolic functional polyester/polyether oligomer or polymer of Claim 1 wherein the catalyst is ethyl tri-p-tolyl phosphonium acetate.

20 12. A process for preparing the epoxy or phenolic functional polyester/polyether oligomer or polymer of Claim 1 which comprises branching an epoxy resin by (1) reacting a liquid epoxy resin (LER), along with a dihydric phenol, with a cyclic anhydride, in the presence of a catalyst, the cyclic anhydride being employed in an amount sufficient to achieve the desired epoxy or phenolic functionality but insufficient to form gels in the anhydride-modified resin.

30 13. The process of Claim 12 wherein the epoxy resin is used in an amount of from about 10 wt. % to about 80 wt. %, based on the weight of the reactants.

14. The process of Claim 13 wherein the epoxy resin is used in an amount of from about 30 wt. % to about 75 wt. % based on the weight of the reactants.

15. The process of Claim 14 wherein the epoxy resin is used in an amount from about 35 wt. % to about 70 wt. %, based on the weight of the reactants.

16. The process of Claim 12 wherein the anhydride is used in an amount of from about 0.1 wt. % to about 20 wt. %, based on the amount of the reactants.

10 17. The process of Claim 16 wherein the anhydride is used in an amount of from about 1 wt. % to about 15 wt. %.

15 18. The process of Claim 17 wherein the anhydride is used in an amount of from about 1 wt. % to about 10 wt. %, based on the weight of the reactants.

19. The process of Claim 12 wherein the dihydric phenol is used in an amount of from about 1 wt. % to about 90 wt. %, based on the weight of the reactants.

20 20. The process of Claim 19 wherein the dihydric phenol is used in an amount of from about 20 wt. % to about 55 wt. %, based on the weight of the reactants.

25 21. The process of Claim 12 wherein the liquid epoxy resin and the dihydric phenol are first reacted and then the cyclic anhydride is added to the reaction mixture.

22. The process of Claim 12 wherein the liquid epoxy resin and the cyclic anhydride are first reacted and then the dihydric phenol is added to the reaction mixture.

23. The process of Claim 12 wherein the dihydric phenol, cyclic anhydride and liquid epoxy resin are reacted in a reactive extruder.

24. The process of Claim 12 wherein the 5 reaction is conducted at a temperature of from about 50°C to about 300°C.

25. The process of Claim 12 wherein the epoxy resin is the diglycidyl ether of bisphenol A, the dihydric phenol is bisphenol A, the cyclic anhydride is phthalic anhydride or maleic anhydride, and the catalyst is ethyl 10 tritolyphosphonium acetate.

26. A binder composition comprising the epoxy or phenolic functional polyester/polyether oligomer or polymer of Claim 1.

15 27. The binder composition of Claim 26 wherein the epoxy-functional polyester/polyether oligomer or polymer is reacted with a hardener.

20 28. The binder composition of Claim 26 wherein the phenolic-functional polyester/polyether oligomer or polymer is reacted with an epoxy functional resin.

29. The binder composition of Claim 27 wherein the hardener is an amine-terminated polymer, a carboxy-terminated polymer, a phenol-terminated polymer, a multifunctional amine, carboxylic acid or phenol.

25 30. The binder composition of Claim 26 containing pigments, fillers or flow modifiers.

31. Powder coatings comprising the binder composition of Claim 26.